Licensable Technologies

PAD: Polymer-Assisted Deposition of Metal-Oxide Films

Applications:

- Semiconductor industry
- Photocatylists
- Photovoltaic solar cells
- Gas sensors
- Waveguides
- Dielectric media

Benefits:

- High-quality film of nearly any metal oxide
- Cost reduction
- Increased metal-oxide film size

Contact:
Russ Hopper, (505) 665-1578
brhopper@lanl.gov

tmt-3@lanl.gov

Technology Transfer Division

Summary:

Metal-oxide films are essential parts of semiconductors. Unfortunately, growing metal-oxide films requires large, expensive equipment. Capital costs for a single metal-oxide film deposition machine can run from $500,000 to $3.5 million, and only very small films can be grown using traditional methods. Los Alamos National Laboratory has developed a simple process of using polymers to grow large quantities of high-quality metal-oxide films. Rather than spray a precise amount of metal oxide in a high vacuum (which requires the expensive equipment), we solubilize the metal oxides in inexpensive polymers, then bake off the polymer, leaving a uniform thin film of metal oxide deposited on the substrate.

A researcher applies a few drops of a water-based PAD solution to a silicon wafer mounted on a spin-coater.

LANL's process is equivalent in quality to industry-standard chemical vapor deposition, yet much cheaper. Polymer-assisted deposition (PAD) is cost effective and can be used to cover much larger areas of substrates with metal-oxides. PAD is also superior to sol-gel methods because PAD can be used with many more metal oxides, the thin film is uniform and is not susceptible to cracking, and because the metal oxide stoichiometry can be precisely controlled.

Currently the semiconductor industry spends $990 million annually on vacuum-based thin-film deposition machines. Another $260 million are spent for thin-film deposition machines outside the semiconductor industry. Thus, the total addressable market is roughly $1.25 billion.

PAD could form the core of a business based on either a pure licensing model or a direct-sales-to-industry model.

Development Stage:

We have demonstrated that PAD works with a wide range of metal-oxide films. Simply put, "problematic" metal oxides are not a problem for PAD. It appears that PAD can be used generally for the high-quality deposition of metal oxides:

- Successful production of both simple and complex metal-oxide films.
- TiO_2
- ITO
- $SrTiO_3$
- Nitrides, sulfides, and carbides could potentially be developed using this process.

Intellectual Property Status:

Patent pending

Licensing Status:

Exclusive and non-exclusive licenses are available.

Los Alamos NATIONAL LABORATORY ESTABLISHED 1943

www.lanl.gov/partnerships/license/technologies/